# Memo

**To:** Anthony Brown - Atlantic Richfield Company

**From:** Marc Lombardi, Principal Geologist
Greg Lambeth, Engineering Geologist

**Project:** 0013091150

**cc:** Amec Foster Wheeler Leviathan Mine Project Staff
Dave McCarthy - Copper Environmental
Randy Miller - Broadbent Associates

**Date:** May 3, 2017

**Subject:** **Hazardous Conditions Response Plan – Crusher Road Slope Instability**

## INTRODUCTION

This memorandum describes newly discovered hazardous conditions associated with an unstable slope at the Leviathan Mine Site in Alpine County, California, and identifies measures to moderate the potential risks to site personnel while those hazardous conditions persist.

## EXISTING CONDITIONS

On April 27, 2017, on-site personnel observed evidence of ground surface movement on the slope east of and above Pond 4. On April 28, 2017, an Amec Foster Wheeler Engineering Geologist (Greg Lambeth) visited the site to perform a preliminary condition assessment. The following description of site conditions is based on that on-site evaluation.

The area of the slope movement is located east of Pond 4, on the uphill slope immediately below the "Crusher Road" and is referred to herein as the Crusher Road Slope Instability. The upper limit (head) is defined by an approximately 200-foot-long zone of tension cracks and scarps located along the west edge of the Crusher Road. The lower limit (toe) is at the base of the slope east of the main site road adjacent to Pond 4, and extends out into the main access road near the southern end of Pond 4. The northern extent of the visible ground cracking is east of the approximate northern end of Pond 4. The southern extent of visible deformation features is approximately 50 feet south of southern edge of Pond 4. The approximate location of the tension cracks, scarps, and slump area of the Crusher Road Slope Instability are shown in Figure 1. Photographs that show site conditions April 28, 2017 and May 2, 2017 are provided in Appendix A.

Evidence of slope instability consists of:

- Tension cracks (ground cracks with no vertical offset) and scarps (ground cracks with vertical offset) along the west side of the Crusher Road.

Amec Foster Wheeler
Environment & Infrastructure, Inc.
10940 White Rock Road, Suite 190
Rancho Cordova, CA 95670

(916) 636-3200

amecfw.com

- A subordinate slope deformation defined by scarps in an arcuate feature in the lower portion of the slope immediately east of the main site road adjacent to the south end of Pond 4.
- A toe bulge in the main site road adjacent to the southern portion of Pond 4.

Continued slope deformation has occurred in the days following discovery of the Crusher Road Slope Instability. Based on current information, it is reasonable to assume that unstable material within the observed extent of the slide will continue to move. There is uncertainty with regards to the velocity, total travel distance, and extent of future slope movements.

## POTENTIAL HAZARDS

Hazards to personnel associated with this slide may include:

- Possibly triggering additional slope instability by operating vehicles or equipment on unstable ground, particularly in the upper (higher elevation) portions of the slide. Added weight in the upper portion of the slide mass can exacerbate the unstable conditions and act as a triggering mechanism. Triggering a slide could present an extreme hazard to personnel on unstable ground.
- Possibly triggering additional slope movements or deformations by operating vehicles or equipment on unstable ground at the toe of the slide. Ground conditions near the base of the slope instability are locally saturated. Water is seeping out of the toe of the Crusher Road Slope Instability, and high water levels in groundwater monitoring wells in the immediate vicinity of the slide suggest the potential for increased pore pressure throughout the area. Moving weight and vibration across this surface could cause further instability.
- Being in the path of moving debris, particularly at or below the lower (lower elevation) portions of the slide.
- Slips, trips, falls associated with working on rough terrain and unstable ground.
- Being exposed to acidic drainage.
    - In the event that a slope failure occurred rapidly and caused slide debris to enter Pond 4, then acidic drainage stored in Pond 4 would be displaced. Debris rapidly entering the pond might cause acidic drainage to splash or spray outside the pond, wave action might cause acidic drainage to overtop the pond embankment, and a sufficiently large volume of slide debris entering Pond 4 could displace a large enough volume to cause acidic drainage to overtop the embankment irrespective of wave action.
    - If the slide extended beneath Pond 4 and movement was extensive enough to cause the plastic liner to fail, then acidic drainage could be released.

## RESPONSE TO HAZARDOUS CONDITIONS

This memorandum establishes an exclusion zone in the vicinity of the Crusher Road Slope Instability. The purpose of this exclusion zone is to minimize the potential hazard exposure to personnel. It is not intended to control possible damage to infrastructure.

Barriers have been placed on the road adjacent to Pond 4 to demarcate the north and south ends of the exclusion zone. Similar barriers were installed on the Crusher Road north of the northern extent of the Crusher Road Slope Instability.

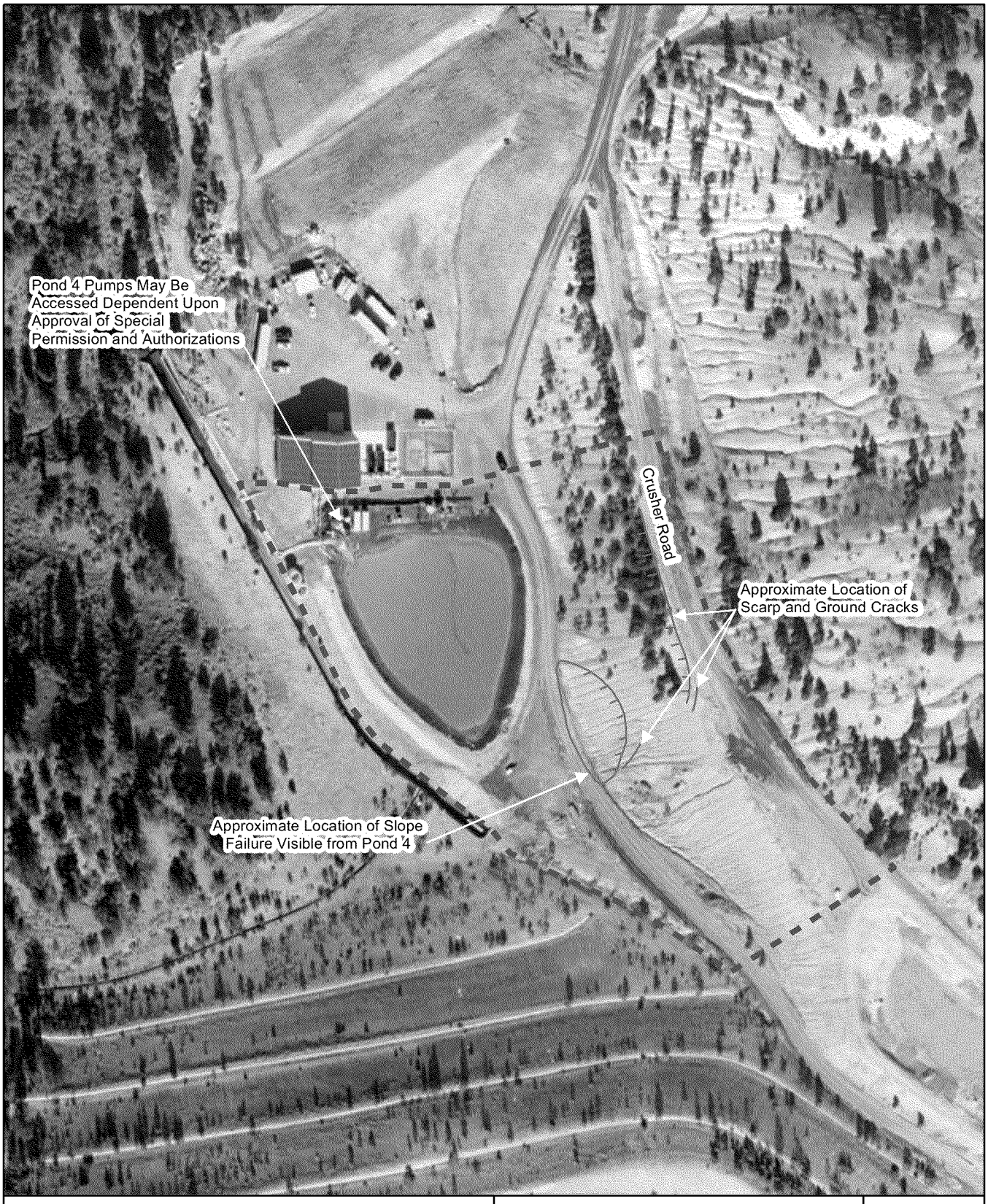
The exclusion zone is shown on Figure 1.

- **The Atlantic Richfield workforce, with the exception noted below, are prohibited from entering the exclusion zone until further notice. This includes entering the exclusion zone on foot, via a vehicle, and via equipment.**
  - The exception is that trained and competent personnel who are evaluating geotechnical conditions and/or conditions that affect safety are allowed to enter the exclusion zone as needed to conduct these evaluations.
  - Permission for entering the exclusion zone to conduct geotechnical evaluations or other work must be requested from site Health, Safety, Security, and Environment (HSSE) personnel prior to entry. Entry will be allowed only if proper HSSE protocols are in place and permission is granted.

Atlantic Richfield personnel have been in communication with staff for the Lahontan Regional Water Quality Control Board (LRWQCB), which is performing spring treatment operations adjacent to Pond 3. Atlantic Richfield verbally informed the LRWQCB of the results of the preliminary condition assessment, the implementation of an Atlantic Richfield exclusion zone, and the recommendation to avoid equipment and vehicle travel above and below the Crusher Road Slope Instability.

**Attachments:**

Figure 1 Crusher Road Slope Instability
Appendix A Crusher Road Slope Instability Photographs




Explanation:

Slide Features

Exclusion Zone

0 100 200 Feet

N

CRUSHER ROAD SLOPE INSTABILITY
Leviathan Mine Site
Alpine County, California

amec foster wheeler

By: DPV
Date: 05/02/2017

Project No. 13091

Figure
1

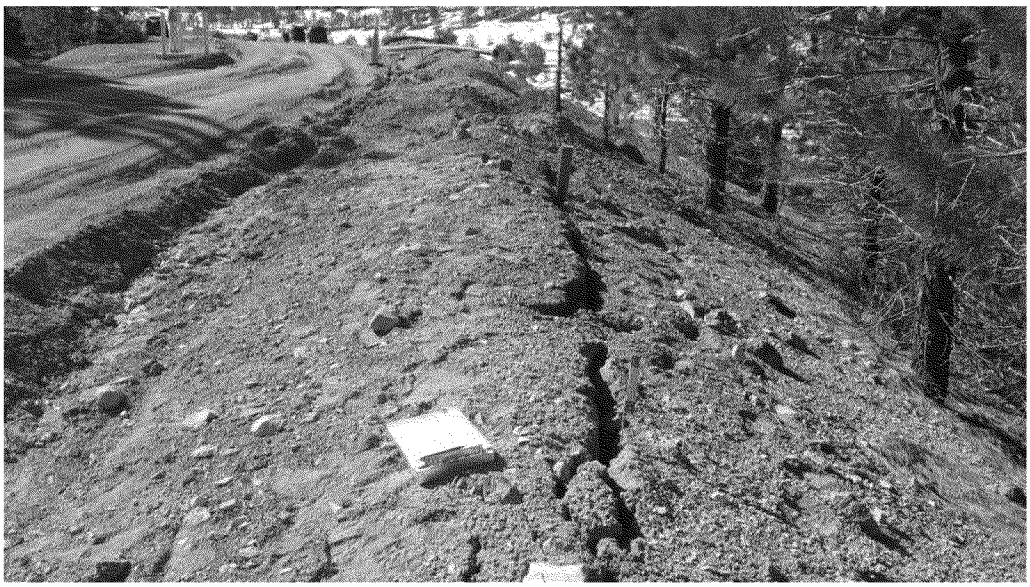
P:\Project\13000s\13091 Leviathan\14000 Database_CAD\CAD\DrawingFiles\HSP\HazConditions.mxd

# ATTACHMENT A
# CRUSHER ROAD SLOPE INSTABILITY PHOTOGRAPHS
Leviathan Mine Site
Alpine County, California

**Photograph A1:** Arcuate shaped scarp outlining subordinate failure on lower portion of Crusher Road slope. View looking north. Photo taken April 28, 2017.

**Photograph A2:** Arcuate shaped scarp outlining subordinated failure on loser portion of Crusher Road Slope. View looking southeast. Photo taken May 2, 2017.

# ATTACHMENT A
# CRUSHER ROAD SLOPE INSTABILITY PHOTOGRAPHS
Leviathan Mine Site
Alpine County, California



**Photograph A3:** Scarp forming at top of Crusher Road slope. View looking south. Photo taken April 28, 2017.

**Photograph A4**: Scarp forming at top of Crusher Road slope. View looking East. Photo taken May 2, 2017.